Notice of Allowability

Application No. 10/743,505	**Applicant(s)** NEARY, DAVID	
Examiner Ted Kim	**Art Unit** 3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to _07/24/2006_.

2. ☒ The allowed claim(s) is/are _22-36_.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)
1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other _sub. spec_.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with David Neary on 8/8/06.

The application has been amended as follows:

SPECIFICATION

- As the substitute specification of 08/02/2006 has been filed with missing pages, the following replacement substitute specification has been received and entered.

- All amendments below are with the substitute specification attached hereto (note that the fonts and formatting differ somewhat from that of 8/02/2006).
- The top paragraph of page 6, has been replaced as follows:

-- The present invention further describes the alternative system and apparatus means for the cited improved partially-open turbine cogeneration system that can be employed within a desired power cogeneration system design, the said alternative system and apparatus means incorporating portions of the heater cycle system and apparatus content cited in the inventor's U.S. Patent application 10/394847 filed March 22, 2003, now U.S.

Patent 7,074,033, ~~and subsequently allowed for present pending US patent publication~~, titled "Partially-Open Fired Heater Cycle Providing High Thermal Efficiencies and Ultra-Low Emissions". The addition of these alternatives to the presented turbine based cogeneration system, as later further described and shown in Figure 2, can increase the presented cogeneration system's overall thermal efficiency to greater than 115%. --

- Beginning with page 8, last paragraph and ending on page 10 of the substitute specification, the following paragraphs have been replaced.

-- It is a fourth ~~forth~~ objective of this invention to provide the collective means by which deviations from the presented invention's example operating conditions can be made to best accommodate a facility designer's incorporation of existing models of other facility auxiliary equipment that can be further incorporated into a specific design of cogeneration facility, such as currently manufactured absorption chillers or mechanically-driven refrigeration chillers that have been conventionally or similarly applied in related waste heat recovery power facilities for over 30 years.

It is a fifth objective of the present invention's cogeneration system and apparatus means to accomplish both a highly accelerated oxy-fuel combustion process and the added means to separately control a preset maximum primary combustion zone temperature and the tertiary zone exhaust gases temperature supplied to the hot gas expander power turbine assembly. This satisfied objective eliminates the elements of sufficient time and high degree of temperature that is required for endothermic dissociation chemical reactions to occur that produces both NO.sub.x and CO within the primary combustion zone product gases.

It is a sixth objective of the present invention of improved system and apparatus means that a power system modified current art gas turbine assembly or alternative new style re-configured turbine train assembly can be capable of achieving an additional 35% to 40% in power cogeneration system thermal efficiencies than are available in current art B.A.T. gas turbine powered cogeneration facilities.

It is a seventh ~~fifth~~ objective of the present invention of improved system and apparatus means that the cited incorporated partial-open gas turbine cycle system and apparatus means of preferred high efficiencies can employ but not be limited to gas compression ratios of 2.4 to 6.4 (2.1 to 6.5 Bar operating pressure) as compared to current art individual gas turbines that may have a compression ratio ranging between approximately 9 to 35.

It is an eighth ~~a sixth~~ objective of the present invention of improved system and apparatus means that the cited partial-open gas turbine cycle system and apparatus can provide the maximum cogeneration thermal efficiencies with facility fuel gas supply pressures of less 100 psig (6.9 bar).

It is a ninth ~~seventh~~ objective of this invention to provide the means wherein, during a steady-state power operation, that the atmospheric vented and open cycle portion of the cogeneration system recycled exhaust mass flow can be approximately 5 to 8% of the total working motive fluid mass flow rate as contained within the closed portion of its turbine power cogeneration system.

It is a tenth ~~ninth~~ objective of this invention to provide the means whereby both the cited partial-open AES turbine cycle system and apparatus as applied within the present invention of improved cogeneration system efficiency, and the alternative cogeneration system apparatus means described herein, can include appropriate safety sensor and system fluid flow control device means. Both the presented invention's

cogeneration system and apparatus component means and the separately associated cogeneration power plant auxiliaries can be monitored and controlled for safe operation, as well as having provided means for controlling the cogeneration system's individual system fluid flows in response to changes in electric power generation demands and effective heat extraction demands by supplied steams of steam or hot water, or process fluids.

It is an eleventh ~~a tenth~~ objective of this invention to provide the apparatus and control means by which a non-distribution quality of gaseous hydrocarbon fuel (containing toxic and/or difficult to combust hydrocarbon molecular gases) can be rapidly carried through oxy-fuel combustion to a useful heat conversion and/or completed incineration. --

CLAIMS

The following amendments to the claims have been made:

Claim 22 (amended): An improved partially-open oxygen-fuel fired turbine powered cogeneration cycle system, with high system thermal efficiencies and low fugitive system exhaust gas emissions for use in generating electric power and for heating of process fluids or gases exclusively using liquid or gaseous hydrocarbon fuel, the cogeneration system comprising:

(a) a gas turbine/generator unit assembly configured to operate within the partially-open cycle to develop a shaft mechanical energy output, the gas turbine power assembly including,

(1) an exhaust gas recycle compressor section configured to compress an inlet supplied re-circulated recycle gas to a higher pressure and temperature prior to the now

identified 'primary re-pressurized recycle gas' being discharged from the gas turbine power assembly,

(2) one or more combustion chamber assemblies ~~assembly~~ in which supplied controlled streams of fuel, predominant oxygen mixture, cooled primary re-pressured recycle gas are mixed and combusted in the presence of an additional controlled supplied second stream of 'working motive composition gases',

(3) a hot gas expander power turbine assembly connected to and downstream of a hot exhaust gas flow conduiting means therein providing an interconnecting supplied stream of highly superheated working motive exhaust gases between the upstream connected combustion chamber assembly's outlet and the downstream connected hot gas expander[[ ]], the supplied flow of working motive fluid gases then being expanded through the expander turbine assembly to produce an efficient energy conversion into mechanical horsepower transmitted by the expander turbine's output shaft;

(b) an electric generator shaft-driven by supplied mechanical horsepower transmitted through shaft means from the expansion turbine's output shaft, the generator further including,

(1) a shaft connecting means which can include a shaft connected gearbox and shaft couplings,

(2) an electric power output transmitted through conduiting means to a control room module which therein can contain the turbine power assembly's PLC control panel, electrical switchgear, and motor control center, whereby electric power production is

controlled and distributed to the power cogeneration facility's electrical grid and/or connected electric utility grid;

(b) a first conduit transporting combustion chamber exhaust gases and having two ends, one end downstream of and connected to the combustion chamber assembly, the other first conduit end connected to the hot gas expander power turbine assembly,

(c) a hot gas expander power turbine assembly configured to accept and expand the higher pressure and higher temperature exhaust gases from the combustion chamber assembly to a lower pressure and lower temperature power turbine exhaust condition to produce mechanical horsepower transmitted by the turbine's output shaft, the turbine exhaust being discharged into a second conduit,

(d) a second conduit transporting the hot gas expander turbine's discharged exhaust gases containing recoverable waste heat[[ ]], the second conduit having two ends, one end downstream of and connected to the hot gas expander turbine assembly, the second conduit's downstream end having two parallel-positioned branches,

(1) the first branch of the second conduit configured to transport a first portion of the hot gas expansion turbine's discharged gases, the first branch end connected downstream to the inlet of a waste heat recovery unit exchanger,

(2) the second branch of the second conduit configured to transport a second portion of the hot gas expander turbine's discharged gases, the second branch end-connected downstream to the inlet of a first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger, the second branch additionally comprising an

auxiliary side-branch end-connected to a blind flange closure means;

(e) a waste heat recovery unit exchanger inlet connected to the downstream end of the first branch of the second conduit, the waste heat recovery unit exchanger configured to transfer recoverable waste heat energy from the turbine exhaust gases supplied by the first branch of the second conduit to the exchanger unit's two integral parallel contained heat exchanger sections containing supplied inlet flows of primary re-pressurized recycle gases ~~as further described later~~,

(f) a first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger inlet connected to the downstream end of the second branch of the second conduit, the first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger configured to transfer recoverable waste heat energy from the turbine exhaust gases supplied through the second branch of the second conduit, the recoverable waste heat transferred to an exchanger fluid exchanger section connected to either process fluid circuit stream flows supplied from a remote source or to steam generation fluid circuit stream flow originating from another source,

(g) a third conduit referred to as a 're-circulated exhaust gas manifold' transporting recirculated exhaust gases, the third conduit having two ends[[ ]], one end upstream of and connected to a downstream positioned second waste heat recovery steam generator or waste heat recovery process fluid exchanger, the third conduit's upstream end connecting to two parallel-positioned branches,

(1) the first branch of the third conduit configured to transport a first controlled portion of recirculated exhaust gases, the first branch upstream end connected to the outlet of the waste heat recovery unit exchanger,

(2) the second branch of the third conduit configured to transport a second controlled portion of recirculated exhaust gases, the second branch upstream end connected to the outlet of the waste heat recovery steam generator or waste heat recovery process fluid heat exchanger;

(h) a second waste heat recovery steam generator or waste heat recovery process fluid exchanger inlet connected to the third conduit transporting recirculated exhaust gases, the waste heat exchanger configured to transfer recoverable waste heat energy from the third conduit's recirculated exhaust gases to either a process fluid stream flow supplied from a remote source or to a steam generation fluid circuit stream flow originating from another source,

(i) a fourth conduit having two ends and referred to as an exhaust gas distribution manifold which transports recirculated exhaust gases at a reduced temperature, the fourth conduit having two ends, one end upstream connected to the outlet of the second waste heat recovery steam generator or waste heat recovery process fluid exchanger, the fourth conduit's other end connected to a blind flange closure means, the fourth conduit having two side branches,

(1) the first side-branch of the fourth conduit configured to transport and exhaust or vent a controlled lesser mass first flow portion of the exhaust gas

distribution manifold's recirculated exhaust gas to atmosphere during the system's operation in a steady-state mode of power generation,

(2) the second side-branch of the fourth conduit configured to transport a second and predominant portion of the total mass flow of the fourth conduit's re-circulated exhaust gases to an inlet of a primary recycle compressor;

(j) a primary recycle gas compressor having an inlet connected to the fourth conduct's second branch's downstream end, the primary recycle gas compressor including,

(1) a compressor input shaft accepting a connected mechanical shaft drive means, the shaft means providing a direct source of power connection to one or more high pressure stages within the hot gas expander turbine,

(2) the primary recycle compressor configured as either a centrifugal or axial type,

(3) a means to increase the pressure and temperature of the compressor's supplied recirculated gases predominantly comprising a mixture of carbon dioxide and water vapor gases of low superheat temperature, and to discharge the gases into a downstream connected fifth conduit;

(k) the fifth conduit configured to transport the primary recycle compressor's discharged flow of primary re-pressurized recycle gases, the fifth conduit having two ends and a side branch, one end downstream of and connected to the primary recycle compressor, and the fifth conduit's side branch downstream end-connected to and

transporting a third controlled lesser flow portion of primary re-pressurized recycle gases to the gas inlet of an air-cooled heat exchanger, the fifth conduit's downstream-positioned second end comprising two parallel-positioned end branches,

(1) the first end branch of the fifth conduit configured to transport a controlled first portion of primary re-pressurized recycle gases end-connected downstream to the inlet gas header of the earlier cited waste heat recovery unit exchanger's first parallel-positioned gas section therein further transporting the supplied primary re-pressurized recycle gases,

(2) the second end branch of the fifth conduit configured to transport a controlled second portion of primary re-pressurized recycle gases, the second branch end connected downstream to the inlet gas header of the earlier cited waste heat recovery unit exchanger's second parallel-positioned gas section therein further transporting primary re-pressurized recycle gases;

(l) a sixth conduit configured to transport a first stream of invention defined 'working motive fluid' composition gases of increased temperature, the sixth conduit having two ends, one end downstream of and connected to the outlet header of the first parallel gas section contained within the waste heat gas recovery unit exchanger, the sixth conduit's second end downstream connected to the tertiary zone contained within the combustion chamber assembly,

(m) a seventh conduit configured to transport a second stream of invention defined 'working motive fluid' composition gases of increased temperature, the conduit having

two ends, one end downstream of and connected to the outlet header of the second parallel gas section contained within the waste heat gas recovery unit exchanger, the seventh conduit second end downstream connected to the primary combustion zone contained within the combustion chamber assembly,

(n) an eighth conduit configured to transport a controlled flow stream of the liquid or gaseous hydrocarbon fuel, the eighth conduit having two ends, one end downstream of and connected to the source of the fuel, the eight conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(o) a ninth conduit configured to transport a controlled flow stream of the predominant oxygen gas mixture, the ninth conduit having two ends, one end downstream of and connected to the source of the predominant oxygen gas mixture, the ninth conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(p) a tenth conduit configured to transport a third and lesser portion of reduced temperature primary re-pressurized recycle gases, the tenth conduit having two ends, one end downstream of and connected to the gas outlet of the air-cooled heat exchanger, the tenth conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(q) a means for system control and safety monitoring ~~of apparatus means~~ configured to maintain the cited system's generated power performance, control of gas

stream flows,[[;]] and ~~apparatus means~~ stream gases in their cited superheated gaseous state.

Claim 23 (amended: The partially-open oxygen-fuel fired turbine power cogeneration cycle system of claim 22 wherein the oxygen-fuel fired combustion chamber assembly including:

(a) a combustion chamber assembly adapted for mixing and combusting controlled supplied streams of a liquid or gaseous hydrocarbon fuel and a pressurized predominate oxygen mixture in the presence of system supplied primary re-pressurized recycle gases and working motive fluid gases, the combustion chamber assembly including,

(1) one or more individual partial premixer subassemblies ~~subassembly~~ having connectivity to controlled supply of pressurized flow streams that can include fuel, predominate oxygen mixture, and a cooled lesser portion of the system's total flow of primary re-pressurized recycle exhaust gases,

(2) a primary combustion zone connected to and positioned downstream of the partial premixer subassembly, the primary combustion zone configured for combusting the controlled pressurized streams of fuel and predominate oxygen mixture to produce a mass flow of pressurized and highly superheated fuel combustion gas products, the primary combustion zone additionally configured to accept a much greater controlled mass flow of the controlled second stream

containing the invention's described 'working motive fluid' gases having a predominant mixture of carbon dioxide and water vapor gases, the second controlled stream of working motive fluid gases therein comprising a substantially lesser superheat temperature than the fuel combustion products temperature,

(3) a tertiary blending zone connected to and positioned downstream of the primary combustion zone, the tertiary zone configured for receiving the mass flow of highly superheated and pressurized gases discharged from the primary combustion zone, the tertiary blending zone additionally configured to accept a greater controlled mass and lesser superheated flow stream containing the invention's described 'working motive fluid' having a predominant mixture of carbon dioxide and water vapor gases, the tertiary blending zone therein blending the cited entering streams of gases to produce a pressurized resultant controlled temperature of working motive fluid gases discharged from the tertiary blending zone within the combustion chamber assembly.

Claim 24 (amended): The partially-open oxygen-fuel fired gas turbine power cogeneration cycle system of claim 22 wherein the control means can be provided by a manufacturer's programmable logic controller based control panel control means can be provided by a manufacturer's programmable logic controller based control panel, the system controlled devices including:

(a) a first control valve in communication with the first branch of the third

conduit,

(b) a second control valve in communication with the second branch of the third conduit,

(c) a third and fourth series-positioned control valve in communication with the first branch of the fourth conduit,

(d) a fifth control valve in communication with the fourth conduit,

(e) a sixth control valve in communication with the eighth conduit,

(f) a seventh control valve in communication with the ninth conduit,

(g) an eighth control valve in communication with the first branch of the fifth conduit, and

(h) a ninth control valve in communication with the second branch of the fifth conduit.

Claim 25 (amended): The partially-open oxygen-fuel fired power cogeneration cycle system of claim 22 wherein the control means maintains the temperature inside the primary combustion zone during combustion at or below ~~the invention's example preferred~~ 2,400 degrees Fahrenheit.

Claim 27 (amended): An ~~alternative configured~~ improved partially-open oxygen-fuel fired turbine powered cogeneration cycle system, with high system thermal efficiencies and low fugitive system exhaust gas emissions for use in generating electric power and

for heating of process fluids or gases exclusively using liquid or gaseous hydrocarbon fuel, the cogeneration system comprising ~~consisting~~ ~~of~~ ~~an~~ ~~alternative configured~~ a hot gas expander turbine/generator unit and separately-driven compressor assembly combination within the system, therein including:

(a) a gas turbine/generator unit assembly configured to operate within the partially-open cycle to develop a shaft mechanical energy output, the gas turbine power unit assembly including,

(1) one or more combustion chamber assemblies ~~assembly~~ in which supplied controlled streams of fuel, predominant oxygen mixture, and cooled primary re-pressured recycle gas are mixed and combusted in the presence of an additional controlled supplied second stream of 'working motive composition gases',

(2) a hot gas expander power turbine unit assembly connected to and downstream of a hot exhaust gas flow conduiting means therein providing an interconnecting supplied stream of highly superheated combustion chamber assembly exhaust gases between the upstream connected combustion chamber assembly's outlet and the downstream connected hot gas expander power turbine unit assembly[[ ]], the supplied flow of working motive fluid gases then being expanded through the hot gas expander power turbine unit assembly to produce an efficient energy conversion into mechanical horsepower transmitted by the expander power-turbine unit's output shaft;

(b) an electric generator shaft-driven by supplied mechanical horsepower transmitted through shaft means from the hot gas expander power turbine unit's output

shaft, the generator further including,

(1) a shaft connecting means which can include a shaft connected gearbox and shaft couplings,

(2) an electric power output transmitted through conduiting means to a control room module which therein can contain the turbine power assembly's PLC control panel, electrical switchgear, and motor control center, whereby electric power production is controlled and distributed to the power cogeneration facility's electrical grid and/or connected electric utility grid;

(b) a first conduit conveying combustion chamber exhaust gases and having two ends, one end downstream of and connected to the combustion chamber assembly, the other first conduit end connected to the hot gas expander power turbine unit assembly,

c) a hot gas expander power turbine unit assembly configured to accept and expand the higher pressure and higher temperature exhaust gases from the combustion chamber assembly to a lower pressure and lower temperature power turbine unit exhaust condition to produce mechanical horsepower transmitted by the power turbine unit's output shaft, the turbine exhaust being discharged into a second conduit,

(d) a second conduit transporting the hot gas expander power turbine unit's discharged exhaust gases containing recoverable waste heat[[ ]], the second conduit having two ends, one end downstream of and connected to the hot gas expander turbine unit assembly, the second conduit's downstream end having two parallel-positioned branches,

(1) the first branch of the second conduit configured to transport a first portion of the hot gas expansion turbine's discharged gases, the first branch end connected downstream to the inlet of a waste heat recovery unit exchanger,

(2) the second branch of the second conduit configured to transport a second portion of the hot gas expander turbine's discharged gases, the second branch end-connected downstream to the inlet of a first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger, the second branch additionally comprising an auxiliary side-branch end-connected to a blind flange closure means;

(e) a waste heat recovery unit exchanger inlet connected to the downstream end of the first branch of the second conduit, the waste heat recovery unit exchanger configured to transfer recoverable waste heat energy from the turbine exhaust gases supplied by the first branch of the second conduit to the exchanger unit's two integral parallel contained heat exchanger sections containing supplied inlet flows of primary re-pressurized recycle gases as further described later,

(f) a first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger inlet connected to the downstream end of the second branch of the second conduit, the first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger configured to transfer recoverable waste heat energy from the turbine exhaust gases supplied through the second branch of the second conduit, the recoverable waste heat transferred to an exchanger fluid exchanger section connected to either process fluid circuit stream flows supplied

from a remote source or to a steam generation fluid circuit stream flow originating from another source,

(g) a third conduit referred to as a 're-circulated exhaust gas manifold' transporting recirculated exhaust gases, the third conduit having two ends[[ ]], one end upstream of and connected to a downstream positioned second waste heat recovery steam generator or waste heat recovery process fluid exchanger, the third conduit's upstream end connecting to two parallel-positioned branches,

(1) the first branch of the third conduit configured to transport a first controlled portion of recirculated exhaust gases, the first branch upstream end connected to the outlet of the waste heat recovery unit exchanger,

(2) the second branch of the third conduit configured to transport a second controlled portion of recirculated exhaust gases, the second branch upstream end connected to the outlet of the waste heat recovery steam generator or waste heat recovery process fluid heat exchanger;

(h) a second waste heat recovery steam generator or waste heat recovery process fluid exchanger inlet connected to the third conduit transporting recirculated exhaust gases, the waste heat exchanger configured to transfer recoverable waste heat energy from the third conduit's recirculated exhaust gases to either a process fluid stream flow supplied from a remote source or to a steam generation fluid circuit stream flow originating from another source,

(i) a fourth conduit having two ends and referred to as an exhaust gas distribution

manifold which transports recirculated exhaust gases at a reduced temperature, the fourth conduit having two ends, one end upstream connected to the outlet of the second waste heat recovery steam generator or waste heat recovery process fluid exchanger, the fourth conduit's other end connected to a blind flange closure means, the fourth conduit having two side branches,

(1) the first side-branch of the fourth conduit configured to transport and exhaust or vent a controlled lesser mass first flow portion of the exhaust gas distribution manifold's recirculated exhaust gas to atmosphere during the system's operation in a steady-state mode of power generation,

(2) the second side-branch of the fourth conduit configured to transport a second and predominant portion of the total mass flow of the fourth conduit's re-circulated exhaust gases to an inlet of a primary recycle compressor;

(j) a primary recycle gas compressor having an inlet connected to the fourth conduct's second branch's downstream end, the primary recycle gas compressor including,

(1) a compressor input shaft accepting a connected mechanical shaft drive means, the shaft means providing either a direct source of power connection to an electric motor or steam turbine driver, or alternately the shaft drive means therein comprising a gear box with couplings that can be end-connected to either the electric motor or the steam turbine driver,

(2) the primary recycle gas compressor configured as either a centrifugal or axial

type,

(3) a means to increase the pressure and temperature of the compressor's supplied recirculated gases predominantly comprising a mixture of carbon dioxide and water vapor gases of low superheat temperature, and to discharge the gases into a downstream connected fifth conduit;

(k) the fifth conduit configured to transport the primary recycle compressor's discharged flow of primary re-pressurized recycle gases, the fifth conduit having two ends and a side branch, one end downstream of and connected to the primary recycle compressor, and the fifth conduit's side branch downstream end-connected to and transporting a third controlled lesser flow portion of primary re-pressurized recycle gases to the gas inlet of an air-cooled heat exchanger, the fifth conduit's downstream-positioned second end comprising two parallel-positioned end branches,

(1) the first end branch of the fifth conduit configured to transport a controlled first portion of primary re-pressurized recycle gases end-connected downstream to the inlet gas header of the earlier cited waste heat recovery unit exchanger's first parallel-positioned gas section therein further transporting the supplied primary re-pressurized recycle gases,

(2) the second end branch of the fifth conduit configured to transport a controlled second portion of primary re-pressurized recycle gases, the second branch end connected downstream to the inlet gas header of the earlier cited waste heat recovery unit exchanger's second parallel-positioned gas section therein further transporting primary re-

pressurized recycle gases;

(l) a sixth conduit configured to transport a first stream of invention defined 'working motive fluid' composition gases of increased temperature, the sixth conduit having two ends, one end downstream of and connected to the outlet header of the first parallel gas section contained within the waste heat gas recovery unit exchanger, the sixth conduit's second end downstream connected to the tertiary zone contained within the combustion chamber assembly,

(m) a seventh conduit configured to transport a second stream of invention defined 'working motive fluid' composition gases of increased temperature, the conduit having two ends, one end downstream of and connected to the outlet header of the second parallel gas section contained within the waste heat gas recovery unit exchanger, the seventh conduit second end downstream connected to the primary combustion zone contained within the combustion chamber assembly,

(n) an eighth conduit configured to transport a controlled flow stream of the liquid or gaseous hydrocarbon fuel, the eighth conduit having two ends, one end downstream of and connected to the source of the fuel, the eight conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(o) a ninth conduit configured to transport a controlled flow stream of the predominant oxygen gas mixture, the ninth conduit having two ends, one end downstream of and connected to the source of the predominant oxygen gas mixture, the

ninth conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(p) a tenth conduit configured to transport a third and lesser portion of reduced temperature primary re-pressurized recycle gases, the tenth conduit having two ends, one end downstream of and connected to the gas outlet of the air-cooled heat exchanger, the tenth conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(q) a means for system control and safety monitoring ~~of apparatus means~~ configured to maintain the cited system's generated power performance, control of gas stream flows,[[;]] and ~~apparatus means~~ stream gases in their cited superheated gaseous state.

Claim 28 (amended): The partially-open oxygen-fuel fired turbine power cogeneration cycle system of claim 27 wherein the oxygen-fuel fired combustion chamber assembly including:

(a) a combustion chamber assembly adapted for mixing and combusting controlled supplied streams of a liquid or gaseous hydrocarbon fuel and a pressurized predominate oxygen mixture in the presence of system supplied primary re-pressurized recycle gases and working motive fluid gases, the combustion chamber assembly including,

(1) one or more individual partial premixer subassemblies ~~subassembly~~ having connectivity to controlled supply of pressurized flow streams that can include fuel, predominate oxygen mixture, and a cooled lesser portion of the system's total

flow of primary re-pressurized recycle exhaust gases,

(2) a primary combustion zone connected to and positioned downstream of the partial premixer subassemblies ~~subassembly~~, the primary combustion zone configured for combusting the controlled pressurized streams of fuel and predominate oxygen mixture to produce a mass flow of pressurized and highly superheated fuel combustion gas products, the primary combustion zone additionally configured to accept a much greater controlled mass flow of the controlled second stream containing the invention's described 'working motive fluid' gases having a predominant mixture of carbon dioxide and water vapor gases, the second controlled stream of working motive fluid gases therein comprising a substantially lesser superheat temperature than the fuel combustion products temperature,

(3) a tertiary blending zone connected to and positioned downstream of the primary combustion zone, the tertiary zone configured for receiving the mass flow of highly superheated and pressurized gases discharged from the primary combustion zone, the tertiary blending zone additionally configured to accept a greater controlled mass and lesser superheated flow stream containing the invention's described 'working motive fluid' having a predominant mixture of carbon dioxide and water vapor gases, the tertiary blending zone therein blending the cited entering streams of gases to produce a pressurized resultant controlled temperature of working motive fluid gases discharged from the tertiary blending zone within the combustion chamber assembly.

Claim 29 (amended): The partially-open oxygen-fuel fired gas turbine power cogeneration cycle system of claim 27 wherein the control means can be provided by a manufacturer's programmable logic controller based control panel, the system controlled devices including:

(a) a first control valve in communication with the first branch of the third conduit,

(b) a second control valve in communication with the second branch of the third conduit,

(c) a third and fourth series-positioned control valve in communication with the first branch of the fourth conduit,

(d) a fifth control valve in communication with the fourth conduit,

(e) a sixth control valve in communication with the eighth conduit,

(f) a seventh control valve in communication with the ninth conduit,

(g) an eighth control valve in communication with the first branch of the fifth conduit, and

(h) a ninth control valve in communication with the second branch of the fifth conduit.

Claim 30 (amended): The partially-open oxygen-fuel fired power cogeneration cycle system of claim 27 wherein the control means maintains the temperature inside the

primary combustion zone during combustion at or below ~~the invention's example preferred~~ 2,400 degrees Fahrenheit.

Claim 32 (amended): A partially-open oxygen-fuel fired ~~alternative configured~~ turbine powered cogeneration cycle system with high system thermal efficiencies and low fugitive system exhaust gas emissions for use in generating electric power and for heating of process fluids or gases through the exclusive use of liquid or gaseous hydrocarbon fuel[[ ]], the system incorporating supplementary ~~apparatus~~ means that enables the system[['s]] to sustain or to increase a production of heated process fluids and/or steam or hot water, regardless of the partially-open cogeneration system's production of mechanical or electric power, the ~~alternative configured~~ partially-open cogeneration system including:

(a) a gas turbine/generator unit assembly configured to operate within the partially-open cycle to develop a shaft mechanical energy output, the gas turbine power assembly including,

(1) an exhaust gas recycle compressor section configured to compress an inlet supplied re-circulated recycle gas to a higher pressure and temperature prior to the now identified 'primary re-pressurized recycle gas' being discharged from the gas turbine power assembly,

(2) one or more combustion chamber assemblies ~~assembly~~ in which supplied controlled streams of fuel, predominant oxygen mixture, cooled primary re-pressured

recycle gas are mixed and combusted in the presence of an additional controlled supplied second stream of 'working motive composition gases',

(3) a hot gas expander power turbine assembly connected to and downstream of a hot exhaust gas flow conduiting means therein providing an interconnecting supplied stream of highly superheated working motive exhaust gases between the upstream connected combustion chamber assembly's outlet and the downstream connected hot gas expander[[ ]], the supplied flow of working motive fluid gases then being expanded through the expander turbine assembly to produce an efficient energy conversion into mechanical horsepower transmitted by the expander turbine's output shaft;

(b) an electric generator shaft-driven by supplied mechanical horsepower transmitted through shaft means from the expansion turbine's output shaft, the generator further including,

(1) a shaft connecting means which can include a shaft connected gearbox and shaft couplings,

(2) an electric power output transmitted through conduiting means to a control room module which therein can contain the turbine power assembly's PLC control panel, electrical switchgear, and motor control center, whereby electric power production is controlled and distributed to the power cogeneration facility's electrical grid and/or connected electric utility grid;

(b) a first conduit transporting combustion chamber exhaust gases and having two ends, one end downstream of and connected to the combustion chamber assembly, the

other first conduit end connected to the hot gas expander power turbine assembly,

(c) a hot gas expander power turbine assembly configured to accept and expand the higher pressure and higher temperature exhaust gases from the combustion chamber assembly to a lower pressure and lower temperature power turbine exhaust condition to produce mechanical horsepower transmitted by the turbine's output shaft, the turbine exhaust being discharged into a second conduit,

(d) a second conduit transporting the hot gas expander turbine's discharged exhaust gases containing recoverable waste heat[[ ]], the second conduit having two ends, one end downstream of and connected to the hot gas expander turbine assembly, the second conduit's downstream end having two parallel-positioned branches,

(1) the first branch of the second conduit configured to transport a first portion of the hot gas expansion turbine's discharged gases, the first branch end connected downstream to the inlet of a waste heat recovery unit exchanger,

(2) the second branch of the second conduit configured to transport a second portion of the hot gas expander turbine's discharged gases, the second branch end-connected downstream to the inlet of a first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger, the second branch additionally comprising an auxiliary side-branch end-connected to flange-connecting conduit ~~16~~ supplying a transported flow of supplementary oxy<u>gen</u>-fuel fired heater-burner exhaust gases~~, as described later~~;

(e) a waste heat recovery unit exchanger inlet connected to the downstream end

of the first branch of the second conduit, the waste heat recovery unit exchanger configured to transfer recoverable waste heat energy from the turbine exhaust gases supplied by the first branch of the second conduit to the exchanger unit's two integral parallel contained heat exchanger sections containing supplied inlet flows of primary re-pressurized recycle gases as further described later,

(f) a first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger inlet connected to the downstream end of the second branch of the second conduit, the first waste heat recovery steam generator or waste heat recovery process fluid heat exchanger configured to transfer recoverable waste heat energy from the turbine exhaust gases supplied through the second branch of the second conduit, the recoverable waste heat transferred to an exchanger fluid exchanger section connected to either process fluid circuit stream flows supplied from a remote source or to a steam generation fluid circuit stream flow originating from another source,

(g) a third conduit referred to as a 're-circulated exhaust gas manifold' transporting recirculated exhaust gases, the third conduit having two ends[[ ]], one end upstream of and connected to a downstream positioned second waste heat recovery steam generator or waste heat recovery process fluid exchanger, the third conduit's upstream end connecting to two parallel-positioned branches,

(1) the first branch of the third conduit configured to transport a first controlled portion of recirculated exhaust gases, the first branch upstream end connected to the

outlet of the waste heat recovery unit exchanger,

(2) the second branch of the third conduit configured to transport a second controlled portion of recirculated exhaust gases, the second branch upstream end connected to the outlet of the waste heat recovery steam generator or waste heat recovery process fluid heat exchanger;

(h) a second waste heat recovery steam generator or waste heat recovery process fluid exchanger inlet connected to the third conduit transporting recirculated exhaust gases, the waste heat exchanger configured to transfer recoverable waste heat energy from the third conduit's recirculated exhaust gases to either a process fluid stream flow supplied from a remote source or to a steam generation fluid circuit stream flow originating from another source,

(i) a fourth conduit having two ends and referred to as an exhaust gas distribution manifold which transports recirculated exhaust gases at a reduced temperature, the fourth conduit having two ends, one end upstream connected to the outlet of the second waste heat recovery steam generator or waste heat recovery process fluid exchanger, the fourth conduit's other end downstream flanged connected to a later described eleventh conduct, the fourth conduit having two side branches,

(1) the first side-branch of the fourth conduit configured to transport and exhaust or vent a controlled lesser mass first flow portion of the exhaust gas distribution manifold's recirculated exhaust gas to atmosphere during the system's operation in a steady-state mode of power generation,

(2) the second side-branch of the fourth conduit configured to transport a second and predominant portion of the total mass flow of the fourth conduit's re-circulated exhaust gases to an inlet of a primary recycle compressor;

(j) a primary recycle gas compressor having an inlet connected to the fourth conduct's second branch's downstream end, the primary recycle gas compressor including,

(1) a means to increase the pressure and temperature of the compressor's supplied recirculated gases predominantly comprising a mixture of carbon dioxide and water vapor gases of low superheat temperature and to discharge the gases into a downstream connected fifth conduit,

(2) a compressor input shaft accepting a connected mechanical shaft drive means, the shaft means providing either a direct source of power connection to one or more high pressure stages within a hot gas expander turbine, or alternately the shaft drive means therein comprising a gear box with couplings that can be end-connected to either an electric motor or a steam turbine,

(3) a primary recycle gas compressor configuration of either the centrifugal or axial type;

(k) the fifth conduit configured to transport the primary recycle compressor's discharged flow of primary re-pressurized recycle gases, the fifth conduit having two ends and a side branch, one end downstream of and connected to the primary recycle compressor, and the fifth conduit's side branch downstream end-connected to and

transporting a third controlled lesser flow portion of primary re-pressurized recycle gases to the gas inlet of an air-cooled heat exchanger, the fifth conduit's downstream-positioned second end comprising two parallel-positioned end branches,

(1) the first end branch of the fifth conduit configured to transport a controlled first portion of primary re-pressurized recycle gases end-connected downstream to the inlet gas header of the earlier cited waste heat recovery unit exchanger's first parallel-positioned gas section therein further transporting the supplied primary re-pressurized recycle gases,

(2) the second end branch of the fifth conduit configured to transport a controlled second portion of primary re-pressurized recycle gases, the second branch end connected downstream to the inlet gas header of the earlier cited waste heat recovery unit exchanger's second parallel-positioned gas section therein further transporting primary re-pressurized recycle gases;

(l) a sixth conduit configured to transport a first stream of invention defined 'working motive fluid' composition gases of increased temperature, the sixth conduit having two ends, one end downstream of and connected to the outlet header of the first parallel gas section contained within the waste heat gas recovery unit exchanger, the sixth conduit's second end downstream connected to the tertiary zone contained within the combustion chamber assembly,

(m) a seventh conduit configured to transport a second stream of invention defined 'working motive fluid' composition gases of increased temperature, the conduit having

two ends, one end downstream of and connected to the outlet header of the second parallel gas section contained within the waste heat gas recovery unit exchanger, the seventh conduit second end downstream connected to the primary combustion zone contained within the combustion chamber assembly,

(n) an eighth conduit configured to transport a controlled flow stream of the liquid or gaseous hydrocarbon fuel, the eighth conduit having two ends, one end downstream of and connected to the source of the fuel, the eight conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(o) a ninth conduit configured to transport a controlled flow stream of the predominant oxygen gas mixture, the ninth conduit having two ends, one end downstream of and connected to the source of the predominant oxygen gas mixture, the ninth conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(p) a tenth conduit configured to transport a third and lesser portion of reduced temperature primary re-pressurized recycle gases, the tenth conduit having two ends, one end downstream of and connected to the gas outlet of the air-cooled heat exchanger, the tenth conduit's second end having downstream flow communication to the partial premixer subassembly within the combustion chamber assembly,

(q) an eleventh conduit configured to transport recirculated exhaust gases at a reduced temperature, the fourth conduit having two ends, one end upstream connected to

the flanged end outlet of the fourth conduit, referred to as the 'exhaust distribution manifold', the eleventh conduct's second end comprising downstream first and second parallel conduit branches,

(1) the first branch end downstream connected to an inlet of a first exhaust recycle gas blower of the speed-control motor-driven type, the first branch of the eleventh conduit incorporating a control valve,

(2) the second branch end downstream connected to an inlet of a second exhaust recycle gas blower of the speed-control motor-driven type, the second branch of the eleventh conduit incorporating a control valve;

(r) a twelfth conduit having two ends, one end downstream of and connected to the outlet of the first exhaust recycle gas blower, the twelfth conduit's second end having downstream communication with the partial-premix subassembly contained within a oxygen-fuel fired combustion heater-burner assembly,

(s) a thirteenth conduit having two ends, one end downstream of and connected to the outlet of the second exhaust recycle gas blower, the thirteenth conduit's second end having downstream communication with the tertiary zone contained within the oxygen-fuel fired combustion heater-burner assembly,

(t) the exhaust recycle gas blowers configured to re-pressurize the blower inlet supplied and slightly superheated recirculated exhaust gases to a increased pressure level required for the gases transport through conduits thirteen and fourteen having end-connection to the downstream-positioned oxygen-fuel fired heater-burner assembly, and

(q) a means for system control and safety monitoring ~~of apparatus means~~ configured to maintain the cited system's generated power performance, control of gas stream flows,[[;]] and ~~apparatus means~~ stream gases in their cited superheated gaseous state.

Claim 33 (new): The partially-open oxygen-fuel fired turbine power cogeneration cycle system of claim 32 wherein a oxygen-fuel fired combustion heater-burner assembly includes:

(a) the combustion heater-burner assembly adapted for mixing and combusting controlled supplied pressurized streams of a liquid or gaseous hydrocarbon fuel and predominate oxygen mixture in the presence of exhaust recycle gas blower supplied re-pressurized recycle gases, the combustion heater-burner assembly including,

(1) one or more individual partial premixer subassemblies ~~subassembly~~ having connectivity to controlled supply of pressurized flow streams that can include fuel, predominate oxygen mixture, and the first blower's supplied re-pressurized recycle exhaust gases,

(2) a primary combustion zone connected to and positioned downstream of the partial premixer subassembly, the primary combustion zone configured for combusting the controlled pressurized streams of fuel and predominate oxygen mixture in the controlled presence of a greater mass flow of re-pressurized recycle gases to produce a resulting mass flow of pressurized and highly superheated primary combustion zone exhaust gases predominantly comprised of carbon dioxide and superheated water vapor,

(3) a tertiary blending zone connected to and positioned downstream of the primary combustion zone, the tertiary zone configured for receiving a mass flow of highly superheated and pressurized gases discharged from the primary combustion zone, the tertiary blending zone additionally configured to accept a first blower supplied controlled mass flow of re-pressurized recycle gases of lesser superheat temperature and having a predominant mixture of carbon dioxide and water vapor gases, the tertiary blending zone therein blending the cited entering streams of gases to produce a pressurized resultant controlled temperature of exhaust gases discharged from the tertiary blending zone within the combustion heater-burner chamber assembly, and

(b) a fifteenth ~~sixteenth~~ conduit having two ends, one end downstream of and connected to the outlet of the oxygen-fuel fired combustion heater-burner assembly, the fifteenth ~~sixteenth~~ conduit's second end having downstream communication with an auxiliary branch contained within a second end branch of the ~~invention's earlier system recited~~ second conduit having a downstream connectivity with a first waste heat recovery steam generator heat exchanger or waste heat recovery process fluid heat exchanger.

Claim 34 (amended): The partially-open oxygen-fuel fired gas turbine power cogeneration cycle system of claim 32 wherein the control means can be provided by a manufacturer's programmable logic controller based control panel, the system controlled devices including:

(a) a first control valve in communication with the first branch of the third conduit,

(b) a second control valve in communication with the second branch of the third conduit,

(c) a third and fourth series-positioned control valve in communication with the first branch of the fourth conduit,

(d) a fifth control valve in communication with the fourth conduit,

(e) a sixth control valve in communication with the eighth conduit,

(f) a seventh control valve in communication with the ninth conduit,

(g) an eighth control valve in communication with the first branch of the fifth conduit,

(h) a ninth control valve in communication with the second branch of the fifth conduit,

(i) a tenth control valve in communication with the first branch of the eleventh conduit,

(j) a eleventh control valve in communication with the second branch of the eleventh conduit,

(k) a twelfth control valve in communication with the fourteenth conduit~~, and~~

~~(l) a thirteenth control valve in communication with the fifteenth conduit~~.

Claim 35 (amended): The partially-open oxygen-fuel fired power cogeneration cycle system of claim 32 wherein the control means maintains the temperature inside the cited combustion chamber assembly's and combustion heater-burner assembly's primary

combustion zones during combustion at or below ~~the invention's example preferred~~ 2,400 degrees Fahrenheit.

REASONS FOR ALLOWANCE

2. The following is an examiner's statement of reasons for allowance: the prior art of record do not fairly teach in permissible combination the claimed invention including paragraphs k-q of claim 22 nor paragraphs k-q of claim 28 nor paragraphs k-q of claim 32. Applicant's terminal disclaimers filed obviate any double patenting rejection previously made.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Contact Information

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Ted Kim whose telephone number is 571-272-4829. The Examiner can be reached on regular business hours before 5:00 pm, Monday to Thursday and every other Friday.

The fax number for the organization where this application is assigned is 571-273-8300.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Thorpe, can be reached at 571-272-4444. Alternate inquiries to Technology Center 3700 can be made via 571-272-3700.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). General inquiries can also be directed to the Patents Assistance Center whose telephone number is 800-786-9199. Furthermore, a variety of online resources are available at http://www.uspto.gov/main/patents.htm

Ted Kim
Primary Examiner
August 15, 2006

Ted Kim	Telephone	571-272-4829
Primary Examiner	Fax (Regular)	571-273-8300
August 15, 2006	Fax (After Final)	571-273-8300
Technology Center 3700	Telephone	571-272-3700